

Transactions in Peer-to-Peer Systems

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Goals of the Thesis

- Discuss usability of transactions for peer-to-peer applications and environment
- Design and implement a transaction service for the JXTA peer-to-peer platform

Transactions & P2P

- Peer-to-peer networks are characterized by absence of stable servers and unreliability of communication channels
 - transactions can provide higher degree of reliability to peer-to-peer applications
 - long-lived transactions are more suitable for a peer-to-peer environment than ACID transactions
- Requirements on a transaction coordination protocol for a peer-to-peer environment
 - support for long-lived transactions between autonomous participants
 - ability to cope with unreliable environment
 - example of such a protocol is BTP

The JXTA Project

- Platform for peer-to-peer applications
 - communication primitives
 - peer groups and services
 - configuration of peers
- Maintained by Sun Microsystems
- <http://www.jxta.org>

The BTP-JXTA Framework

- Transaction service for the JXTA platform
- Uses BTP as a coordination protocol
 - peers are autonomous participants & peer-to-peer environment is unreliable \Rightarrow BTP is suitable for transactions in peer-to-peer systems
- JXTA platform is used mainly for exchange of messages between participants in transactions
- Implemented in the Java language

Design Goals and Principles

- Practical usability
- Lightweight architecture
- Easy learning curve
- Use of concepts from the BTP specification
- Object-oriented design

Testing

- Unit tests verify correctness of implementation of selected classes in the BTP-JXTA framework
- Extension of the JUnit framework with AOP
 - aspects are used to capture runtime behavior of the framework (method calls, message exchanges, etc.)
 - the AspectJ framework is used for AOP
- Functional tests verify several common courses of transactions

Examples

- Example applications illustrate practical usability of the BTP-JXTA framework
- Each example application represents a different kind of peer-to-peer applications that can possibly utilize transactions
 - DirSynch - synchronization of directories
 - Account - distributed account
 - DistComp - distributed computing

Conclusion

- The BTP-JXTA framework
 - fulfills all design goals and principles
 - is tested with unit and functional tests
 - its learning curve is comparable with learning curve of the JTA/JTS and OMG OTS frameworks
- Approved as a sub-project of the JXTA Project
 - available at <http://btp-jxta.jxta.org>